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Patent
Attorney's Docket No. 032619-030

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	
Oliver LEGENDRE et al.	)	Group Art Unit: 1764
	)	
Application No.: 08/914,244	)	Examiner: I. Bullock
	)	
Filed: August 19, 1997	)	Appeal No.
	)	
For: CATALYTIC TREATMENT OF GASEOUS EFFLUENTS CONTAINING VARYING AMOUNTS OF SULFUR COMPOUNDS	)	

BRIEF FOR APPELLANT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This appeal is from the decision of the Primary Examiner dated May 27, 1999 (Paper No. 14), finally rejecting claims 1-23, which are reproduced as an Appendix to this brief.

The Commissioner is hereby authorized to charge [ ] $150.00 (220) [X] $300.00 (120) for the Government fee to Deposit Account No. 02-4800 and two extra copies of this brief are being filed herewith.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800. This paper is submitted in triplicate.

I. Real Party in Interest

The present application is assigned to Institut Francais Du Petrole.

II. Related Appeals and Interferences

The Appellants' legal representative, or assignee does not know of any other appeal or interferences which will affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1-23 stand rejected in the May 27, 1999 final Official action.

IV. Status of Amendments

No amendments to the claims have been filed subsequent to the May 27, 1999 final Official Action.

V. Summary of the Invention

The invention relates to novel catalysts for the purification/treatment of gases, especially of gaseous industrial effluents containing sulfur compounds, particularly to recover elemental sulfur therefrom, and more especially to novel catalysts for the Claus reaction and/or the hydrolysis of organic sulfur compounds (specification at page 1, lines 5-11). It has unexpectedly been determined that the extent of the sodium content of alumina is a primary factor in the deactivation thereof, especially by sulphate formation (specification at page 3, lines 11-14). According to the invention, a catalytically active alumina comprises sodium values wherein the sodium content of the alumina ranges from 1,200 to 2,500 ppm of Na_2O by weight thereof (specification at page 3, lines 19-26).

The figure of the drawing is a graph plotting the conversion of CS_2 as a function of the Na_2O content in various alumina catalysts (specification at page 4, lines 2-4). In Example 2, catalysts having various Na_2O contents were prepared and the catalytic activity thereof was tested by contacting the catalysts with a gas having the composition set forth in

the table on page 9 of the specification. As shown in the figure, the conversion of CS_2 was unexpectedly improved when the Na_2O range was limited to 1,200 to 2,500 ppm.

VI. The Issues

The sole issue presented by this appeal is the rejection of Claims 1-23 under 35 U.S.C. §103 over U.S. Patent No. 4,364,858 ("Goodboy") in view of U.S. Patent No. 5,244,648 ("Dupin") or U.S. Patent No. 3,856,708 ("Carithers").

VII. Grouping of Claims

Claims 1, 11, 12, 13, 14 and 15 are independent claims which recite the common feature of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values wherein the effective amount, expressed by weight of Na_2O, ranges from 1,200 pm to 2,500 ppm (Claim 1) or 1,200 ppm to 2,700 ppm (Claims 11-15). If the Board of Parent Appeals and Interferences ("BPAI") agrees that Appellants have established that the claimed catalyst achieves unexpected results sufficient to rebut the obviousness rejection, then all claims should be allowable. If the BPAI affirms the rejection of Claim 1, it is submitted that the remaining claims do not fall with Claim 1 for the following reasons.

Claim 4 recites that the activated alumina catalyst as defined by Claim 1 further comprises silica and/or at least one oxide of titanium, zirconium, cerium, tin, a rare earth, molybdenum, cobalt, nickel or iron. In the Official Action, Goodboy is cited for a disclosure of activated alumina used as a catalyst base (support) to which "compounds" of Mo, Co, Ni, Fe, U, Ca, Zn, Ti and others are added (see Official Action at page 3 citing column 6, lines 62-68 of Goodboy). Because Goodboy does not mention silica or "oxides" of Ti, Zr, Ce, Sn, a rare earth, Mo, Co, Ni or Fe, Claim 4 further patentably distinguishes the claimed invention over Goodboy.

Claim 5 recites that the activated alumina catalyst as defined by Claim 1 further comprises a clay, a silicate, an alkaline earth metal or ammonium sulfate, ceramic fibers, asbestos fibers, or combination thereof. Because the Official Action does not explain where

the features of Claim 5 can be found in the prior art, Claim 5 further patentably distinguishes the claimed invention over Goodboy.

Claim 6 recites that the activated alumina catalyst as defined by Claim 1 further comprises cellulose, carboxymethyl cellulose, carboxyethyl cellulose, tallol, a xanthan gum, a surface-active agent, a flocculating agent, a polyacrylamide, carbon black, a starch, stearic acid, polyacrylic alcohol, polyvinyl alcohol, a biopolymer, glucose, a polyethylene glycol, or combination thereof. In the Official Action, Dupin and Carithers are cited for a suggestion to add cellulose to the Goodboy activated alumina for purposes of forming pores (see page 4 of the Official Action). Dupin, however, suggests lowering the Na_2O content to less than 1000 ppm (column 3, lines 46-49) and Carithers discloses two hydrates used to prepare a catalyst for automotive exhaust gas conversion wherein the hydrates had Na_2O contents of 0.18% and 0.19% but the final calcinated products had Na_2O contents of 0.064%, 0.097%, 0.064%, 0.059% and 0.063%, i.e., no more than 970 ppm Na_2O (see Tables I and II of Carithers). As such, the combination of features recited in Claim 6 further patentably distinguishes the claimed invention over the prior art.

Claim 7 recites that the activated alumina catalyst as defined by Claim 1 comprises extrudates, tablets, or beads thereof. Goodboy discloses that the catalysts according to the Goodboy invention are used in fixed or mobile beds with the dimensions of the constituent grains being adapted to the particular situation (see column 7, lines 1-4 of Goodboy). In the Official Action, Dupin is cited for a suggestion to agglomerate the Goodboy catalyst by pelletizing, extrusion and shaping into beads (see page 4 of the Official Action). Dupin, however, suggests lowering the Na_2O content to less than 1000 ppm (column 3, lines 46-49). As such, the combination of features recited in Claim 7 further patentably distinguishes the claimed invention over the prior art.

Claim 8 recites that the activated alumina catalyst as defined by Claim 7 comprises a plurality of beads having a diameter size ranging from 1.5 mm to 10 mm. The Official Action does not address Claim 8. As such, the combination of features recited in Claim 8 further patentably distinguishes the claimed invention over the prior art.

Claim 9 recites that the beads as defined by Claim 8 have a diameter size ranging

from 3 mm to 7 mm. The Official Action does not address Claim 9. As such, the combination of features recited in Claim 9 further patentably distinguishes the claimed invention over the prior art.

Claim 10 recites that the activated alumina catalyst as defined by Claim 1 is deposited onto a support substrate therefor. The Official Action does not address Claim 10. As such, the combination of features recited in Claim 10 further patentably distinguishes the claimed invention over the prior art.

Claim 11 recites a catalyst comprising at least 0.5% by weight of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 11. As such, the combination of features recited in Claim 11 further patentably distinguishes the claimed invention over the prior art.

Claim 12 recites a catalyst comprising from 60% to 99% by weight of activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 12. As such, the combination of features recited in Claim 12 further patentably distinguishes the claimed invention over the prior art.

Claim 13 recites a process wherein a catalyzed Claus reaction is used for the production of elemental sulfur, the improvement comprising using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 13. As such, the combination of features recited in Claim 13 further patentably distinguishes the claimed invention over the prior art.

Claim 14 recites a process for the catalyzed hydrolysis of an organosulfur compound wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 14. As such, the combination of features

recited in Claim 14 further patentably distinguishes the claimed invention over the prior art.

Claim 15 recites a process for catalytically removing objectionable sulfur compounds from gaseous effluents comprised thereof wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 15. As such, the combination of features recited in Claim 15 further patentably distinguishes the claimed invention over the prior art.

Claim 16 recites that the activated alumina catalyst as defined by Claim 1 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 16.

Claim 17 recites that the activated alumina catalyst as defined by Claim 11 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration")

submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 17.

Claim 18 recites that the activated alumina catalyst as defined by Claim 12 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 18.

Claim 19 recites that the activated alumina catalyst as defined by Claim 13 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of

Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 19.

Claim 20 recites that the activated alumina catalyst as defined by Claim 14 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 20.

Claim 21 recites that the activated alumina catalyst as defined by Claim 15 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 21.

Claim 22 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having a diameter of 3.1 to 6.3 mm and specific surface area of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. Further, the Official Action concedes that Goodboy fails to teach or suggest providing the Goodboy activated alumina in the form of beads with the claimed size (see Official Action at page 4, lines 1-3). As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g) and the bead particle size is 3.1 to 6.3 mm, it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 22.

Claim 23 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having (a) pore volume of alumina of pores of diameter greater than 0.1 μm of 18.5 ml/100g and (b) pore volume of pores of alumina of diameter greater than 1 μm of 15.5 ml/100g. The Official Action concedes that Goodboy fails to teach or suggest providing the Goodboy activated alumina in the form of beads with the claimed pore volumes (see Official Action at page 4, lines 1-3). As established by example 2 of Appellants' specification, when the pore volume of pores of diameter greater than 0.1 μm is 18.5 ml/100 g of alumina and the pore volume of pores of diameter greater than 1 μm is 15.5 ml/100 g of alumina, it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is

not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 23.

VIII. Argument

A. The §103 Rejection

Claims 1-23 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Goodboy in view of Dupin or Carithers. This rejection should be reversed for the following reasons.

B. Subject Matter Set Forth In Claim 1 Compared to Goodboy

Claim 1 sets forth an activated alumina catalyst comprising a cocatalytically effective amount of sodium values wherein the effective amount, expressed by weight of Na_2O, ranges from 1,200 pm to 2,500 ppm. Goodboy, on the other hand, relates to an activated catalyst having an overlapping sodium oxide content for purposes of providing resistance to sulfate poisoning (column 3, lines 10-33 of Goodboy). Goodboy states that a high sodium oxide content is beneficial for achieving low CO_2 chemisorption and the preferred amount of Na_2O is 5000 ppm and above (see column 3, line 54 through column 4, line 22 of Goodboy). Goodboy does not disclose or suggest an activated alumina catalyst having a cocatalytically effective amount of sodium values for conversion of CS_2 wherein the effective amount is expressed by weight of Na_2O ranging from 1200 to 2500 ppm. As such, it is submitted that Goodboy taken alone or in combination with the remaining references (both of which also teach high sodium oxide contents) fails to suggest the combination of features recited in Claim 1.

C. Standard For Overcoming §103 Rejections

In In re Baird, 29 USPQ 2d 1550 (Fed. Cir. 1994), the court stated that "[t]he fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious." Also, evidence of unexpectedly good results can overcome a rejection based on optimization of a "result effective variable" provided the

unexpected results are established by factual evidence. In re DeBlauwe, 222 USPQ 191, at 196 (Fed. Cir. 1994). With respect to optimization, in In re Antonie, 195 USPQ 6, 8 (CCPA 1977), the court stated that:

> The PTO and the minority appear to argue that it will always be obvious for one of ordinary skill in the art to try varying every parameter of a system in order to optimize the effectiveness of the system even if there is no evidence in the record that the prior art recognized that particular parameter effected the result. As we have said many times, obvious to try is not the standard of 35 U.S.C. §103. (Emphasis in original.) Antonie, at 8.

The court in Antonie also stated that while the discovery of an optimum of a variable in a known process is normally obvious, there are two exceptions to the rule. The first exception is when the results of optimizing a variable, which was known to be result effective, were unexpectedly good. The second exception is in the case where the parameter optimized was not recognized to be a result-effective variable. In the present case, both exception apply since Goodboy provides no recognition that low Na_2O contents would be effective in providing improved CS_2 conversion rates.

D. **Reasons Claim 1 Is Patentable Over Goodboy**

Goodboy states that increased sulfur conversion can be obtained using an activated alumina catalyst in which sodium oxide concentration, LOI (hydroxyl content determined by heating from 400° to 1100°C) and surface area are controlled (column 3, lines 17-21 and 31-32 of Goodboy). Goodboy discloses a broad range of 0.1 to 2.5 wt % sodium oxide but prefers 0.50 to 2.5 wt % on a 1000°C calcined basis (column 3, lines 57-60 of Goodboy). Goodboy teaches away from low sodium oxide contents at column 4, lines 18-35 wherein it is stated "low sodium oxide content was believed to be desirable...[but contrary] to this expectation, significant amounts of sodium oxide are not only tolerable to a Claus catalyst, but , in fact, are beneficial . . ."

Goodboy's Examples 1-9 show a conversion rate of "S" of 79.1 to 82.9% for Na_2O contents of 0.44, 1.36, 0.43, 0.41, 0.09, 2.10, 0.10 and 0.33 wt % (1000°C Basis)

according to Table I of Goodboy. Such results would be plotted as an essentially flat curve, the conversion rate of 0.09 and 0.10 wt % Na_2O being essentially the same as that of the 0.33 wt % and above Na_2O contents. Further, it is noted that Goodboy measured SO_2 chemisorption rather than conversion of CS_2.

It is well established that the unexpected discovery of improved results for a limited range within a broader range merits patent protection. See Baird, supra. In view of Goodboy's preference for Na_2O contents in amounts of 0.5% and above and Goodboy's data showing essentially the same conversion rate for Na_2O contents of 0.09 to 2.10%, the skilled artisan would not have expected low Na_2O contents to produce the dramatic improvement in CS_2 conversion discovered by Applicants. It is submitted that Appellants' showing of unexpected improvement in CS_2 conversion rates for the claimed range of 0.12 to 0.25% Na_2O rebuts any prima facie case of obviousness based on Goodboy.

The Nedez Declaration includes Attachment I wherein CS_2 conversion is plotted with respect to various Na_2O contents in a gas-catalyst prepared according to the process set forth in paragraph 2 of the Nedez Declaration. Attachment I shows the interpolated data corresponding CS_2 conversion rate for the closest Na_2O examples of Goodboy compared to the claimed 1,200 to 2,500 ppm Na_2O range (see paragraph 7 of the Nedez Declaration). Attachment I shows that the claimed 1,200 to 2,500 ppm Na_2O content provides new and unexpected results with respect to CS_2 conversion compared to Na_2O contents above and below the claimed range.

In the final Official Action, it is stated that Goodboy discloses "a Claus catalyst in the form of activated alumina containing sodium oxide in an amount greater than 0.1 wt% of the catalyst, preferably between 0.1 and 2.5 wt%" (Official Action at page 3). In addition, the Official Action states that "the catalyst possesses . . . higher catalytic activity with respect to compounds such as . . . CS_2 . . ." (Official Action at page 5). Further, while it was acknowledged in the November 2, 1998 Official Action that "a catalyst is unpredictable" it is argued in the Official Action that "sodium oxide is a recognized result-effective parameter" (November 2, 1998 Official Action at page 8), the final Official Action argues that a skilled artisan "would reasonably expect that within the . . . sodium oxide

concentration taught by Goodboy an optimum concentration for catalytic activity with respect to CS_2, H_2S, SO_2 and COS would differ for each" (final Official Action at pages 7-8). However, in view of Goodboy's Examples 1-9 wherein SO_2 conversion is essentially the same (79.1 to 82.9%) for all Na_2O contents in the range of 0.09 to 2.10 wt % Na_2O, it is submitted that one of ordinary skill in the art would not have expected to find an "optimum" concentration of Na_2O based on the teachings of Goodboy. Besides, whether or not the effect of Na_2O is a recognized result effective variable, unexpectedly improved results for a recognized result effect variable can overcome a prima facie case of obviousness. See Antonie, supra. Accordingly, the rejection of Claim 1 should be reversed.

E. **Reasons Why Remaining Claims Are Patentable Over Cited References**

The Official Action cites Dupin and Carithers to cure various deficiencies of Goodboy with respect to features recited in claims other than Claim 1. These secondary references are discussed below in connection with various dependent and independent claims which do not stand or fall with Claim 1.

Claim 4 recites that the activated alumina catalyst as defined by Claim 1 further comprises silica and/or at least one oxide of titanium, zirconium, cerium, tin, a rare earth, molybdenum, cobalt, nickel or iron. In the Official Action, Goodboy is cited for a disclosure of activated alumina used as a catalyst base (support) to which "compounds" of Mo, Co, Ni, Fe, U, Ca, Zn, Ti and others are added (see Official Action at page 3 citing column 6, lines 62-68 of Goodboy). Because Goodboy does not mention silica or "oxides" of Ti, Zr, Ce, Sn, a rare earth, Mo, Co, Ni or Fe, Claim 4 further patentably distinguishes the claimed invention over Goodboy.

Claim 5 recites that the activated alumina catalyst as defined by Claim 1 further comprises a clay, a silicate, an alkaline earth metal or ammonium sulfate, ceramic fibers, asbestos fibers, or combination thereof. Because the Official Action does not explain where the features of Claim 5 can be found in the prior art, Claim 5 further patentably distinguishes the claimed invention over Goodboy.

Claim 6 recites that the activated alumina catalyst as defined by Claim 1 further comprises cellulose, carboxymethyl cellulose, carboxyethyl cellulose, tallol, a xanthan gum, a surface-active agent, a flocculating agent, a polyacrylamide, carbon black, a starch, stearic acid, polyacrylic alcohol, polyvinyl alcohol, a biopolymer, glucose, a polyethylene glycol, or combination thereof. In the Official Action, Dupin and Carithers are cited for a suggestion to add cellulose to the Goodboy activated alumina for purposes of forming pores (see page 4 of the Official Action). Dupin, however, suggests lowering the Na_2O content to less than 1000 ppm (column 3, lines 46-49) and Carithers discloses two hydrates used to prepare a catalyst for automotive exhaust gas conversion wherein the hydrates had Na_2O contents of 0.18% and 0.19% but the final calcinated products had Na_2O contents of 0.064%, 0.097%, 0.064%, 0.059% and 0.063%, i.e., no more than 970 ppm Na_2O (see Tables I and II of Carithers). As such, the combination of features recited in Claim 6 further patentably distinguishes the claimed invention over the prior art.

Claim 7 recites that the activated alumina catalyst as defined by Claim 1 comprises extrudates, tablets, or beads thereof. Goodboy discloses that the catalysts according to the Goodboy invention are used in fixed or mobile beds with the dimensions of the constituent grains being adapted to the particular situation (see column 7, lines 1-4 of Goodboy). In the Official Action, Dupin is cited for a suggestion to agglomerate the Goodboy catalyst by pelletizing, extrusion and shaping into beads (see page 4 of the Official Action). Dupin, however, suggests lowering the Na_2O content to less than 1000 ppm (column 3, lines 46-49). As such, the combination of features recited in Claim 7 further patentably distinguishes the claimed invention over the prior art.

Claim 8 recites that the activated alumina catalyst as defined by Claim 7 comprises a plurality of beads having a diameter size ranging from 1.5 mm to 10 mm. The Official Action does not address Claim 8. As such, the combination of features recited in Claim 8 further patentably distinguishes the claimed invention over the prior art.

Claim 9 recites that the beads as defined by Claim 8 have a diameter size ranging from 3 mm to 7 mm. The Official Action does not address Claim 9. As such, the combination of features recited in Claim 9 further patentably distinguishes the claimed

invention over the prior art.

Claim 10 recites that the activated alumina catalyst as defined by Claim 1 is deposited onto a support substrate therefor. The Official Action does not address Claim 10. As such, the combination of features recited in Claim 10 further patentably distinguishes the claimed invention over the prior art.

Claim 11 recites a catalyst comprising at least 0.5% by weight of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 11. As such, the combination of features recited in Claim 11 further patentably distinguishes the claimed invention over the prior art.

Claim 12 recites a catalyst comprising from 60% to 99% by weight of activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 12. As such, the combination of features recited in Claim 12 further patentably distinguishes the claimed invention over the prior art.

Claim 13 recites a process wherein a catalyzed Claus reaction is used for the production of elemental sulfur, the improvement comprising using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 13. As such, the combination of features recited in Claim 13 further patentably distinguishes the claimed invention over the prior art.

Claim 14 recites a process for the catalyzed hydrolysis of an organosulfur compound wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 14. As such, the combination of features recited in Claim 14 further patentably distinguishes the claimed invention over the prior art.

Claim 15 recites a process for catalytically removing objectionable sulfur

compounds from gaseous effluents comprised thereof wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm. The Official Action does not address Claim 15. As such, the combination of features recited in Claim 15 further patentably distinguishes the claimed invention over the prior art.

Claim 16 recites that the activated alumina catalyst as defined by Claim 1 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 16.

Claim 17 recites that the activated alumina catalyst as defined by Claim 11 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the

grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 17.

Claim 18 recites that the activated alumina catalyst as defined by Claim 12 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 18.

Claim 19 recites that the activated alumina catalyst as defined by Claim 13 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 19.

Claim 20 recites that the activated alumina catalyst as defined by Claim 14 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 20.

Claim 21 recites that the activated alumina catalyst as defined by Claim 15 has a specific surface of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g), it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 21.

Claim 22 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having a diameter of 3.1 to 6.3 mm and specific surface area of 350 to 370 m^2/g. Although the Official Action cites column 3, lines 65-68 of Goodboy for a

suggestion to provide a specific surface of at least 300 m^2/g, there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m^2/g. Further, the Official Action concedes that Goodboy fails to teach or suggest providing the Goodboy activated alumina in the form of beads with the claimed size (see Official Action at page 4, lines 1-3). As established by example 2 of Appellants' specification, when the specific surface is 360 m^2/g (± 10 m^2/g) and the bead particle size is 3.1 to 6.3 mm, it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 22.

Claim 23 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having (a) pore volume of alumina of pores of diameter greater than 0.1 μm of 18.5 ml/100g and (b) pore volume of pores of alumina of diameter greater than 1 μm of 15.5 ml/100g. The Official Action concedes that Goodboy fails to teach or suggest providing the Goodboy activated alumina in the form of beads with the claimed pore volumes (see Official Action at page 4, lines 1-3). As established by example 2 of Appellants' specification, when the pore volume of pores of diameter greater than 0.1 μm is 18.5 ml/100 g of alumina and the pore volume of pores of diameter greater than 1 μm is 15.5 ml/100 g of alumina, it is possible to achieve the unexpected improvement in conversion of CS_2 set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 23.

F. **Showing of Unexpected Results**

In the Official Action, it is stated that "[i]t is well settled that a patent cannot be granted for an applicant's discovery of a result, even though it may be unexpectedly good, which would flow logically from the teaching of the prior art" citing In re Rau, 117 USPQ 215 (CCPA 1958). The Rau decision does not appear in §716 "Affidavits or Declarations Traversing Rejections, 37 CFR 1.132" of the Manual of Patent Examining Procedure ("MPEP) or in Appendix II of the MPEP. In the present case, Appellants have discovered that unexpectedly good conversion of CS2 can be obtained by using an activated alumina catalyst comprising a cocatalytically effective amount of sodium values expressed by weight of Na_2O ranging from 1200 ppm to 2500 ppm (Claim 1) or 1200 ppm to 2700 ppm (Claims 11-15). To the extent that Goodboy discloses an overlapping Na_2O content, MPEP §716.02(d) "Unexpected Results Commensurate in Scope With Claimed Invention - Demonstrating Criticality of a Claimed Range" states:

"To establish unexpected results over a claimed range, applicants should compare a sufficient number of tests both inside and outside the claimed range to show the criticality of the claimed range. In re Hill, 284 F.2d 955, 128 USPQ 197 (CCPA)."

The Rau decision does not discuss the showing necessary to demonstrate criticality of a claimed range, and therefore Rau is not applicable to the issues presented by this appeal. As set forth in MPEP § 716.02(d), "the showing of unexpected results must be reviewed to see if the results occur over the entire claimed range." In the present case, an examination of Exhibit I of the Nedez Declaration shows that the improvement of CS_2 conversion occurs over the entire claimed range.

As set forth in MPEP § 716.02(e) "Comparison With Closest Prior Art," it is necessary to compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. In the present case, an examination of Exhibit I of the Nedez Declaration shows that the improvement of CS_2 conversion occurs over the entire claimed range and that the closest examples of Goodboy (900 ppm, 1000 ppm and 3300 ppm) do not achieve the unexpected improvement in CS_2 conversion achieved by Na_2O contents within the claimed range.

As set forth in MPEP § 716.02 "Allegations Of Unexpected Results," it is necessary to determine whether the properties differ to such an extent that the difference is really unexpected. This portion of the MPEP cites In re Waymouth, 499 F.2d 1273, 182 USPQ 290, 293 (CCPA 1974) for the following test:

". . . unexpected results for a claimed range as compared with the range disclosed in the prior art had been shown by a demonstration of a 'marked improvement, over the results achieved under other ratios, as to be classified as a difference in kind, rather than one of degree.'"

A review of Exhibit I of the Nedez Declaration reveals that the CS_2 conversion drops off dramatically at values above 2700 ppm Na_2O and below 1200 Na_2O. Such results are truly unexpected in view of Goodboy's preference for Na2O contents above 0.50 % (5000 ppm) in order to reduce SO_2 chemisorption upon the catalyst (see column 3, line 54 through column 4, line 6 of Goodboy). Goodboy discloses that "[i]n order to achieve low SO_2 chemisorption . . . high sodium oxide content [is] beneficial" (see column 4, lines 18-22 of Goodboy). Accordingly, while Goodboy discloses an overlapping range of Na_2O, Goodboy teaches away from the claimed range which Appellants have shown produces unexpected improvement in CS_2 conversion.

The Official Action takes the position that "[a] skilled artisan would recognize that the amount of sodium oxide required for optimum results would differ for each of said recited compounds" and that depending on the process for which the catalyst is to be employed, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to have determined the optimum concentration of sodium oxide because sodium oxide is a recognized result-effective parameter' (Official Action at pages 6-7). However, such an approach by the Examiner is contrary to the decision in Antonie. That is, the court in Antonie stated that while the discovery of an optimum of a variable in a known process is normally obvious, there are two exceptions to the rule. The first exception is when the results of optimizing a variable, which was known to be result effective, were unexpectedly good. The second exception is in the case where the parameter optimized was not recognized to be a result-effective variable. In the present case, both exceptions apply since (1) Goodboy provides no recognition that low Na_2O

contents would be effective in providing improved CS_2 conversion rates and (2) the Nedez Declaration establishes that even if the Na_2O content of Goodboy is held by the BPAI to be a result effective variable as alleged by the Examiner, the claimed Na_2O content achieves CS_2 conversion rates which are "unexpectedly good" compared to the closest examples in Goodboy.

G. **Summary**

From the foregoing discussion, it is submitted that any prima facie case of obviousness is overcome by the Nedez Declaration which shows that the claimed Na_2O range produces unexpected improvement in CS_2 conversion in comparison to the closest examples interpolated using Attachment I of the Nedez Declaration) of Goodboy.

IX. Conclusion

In view of the foregoing, it is respectfully submitted that the claimed invention is not disclosed or suggested by the prior art of record and that any prima facie case of obviousness has been rebutted by the Nedez Declaration. Accordingly, reversal of the rejection over Goodboy in View of Dupin and Carithers is respectfully requested.

Respectfully submitted,

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APPENDIX

The Appealed Claims

1. An activated alumina catalyst comprising a cocatalytically effective amount of sodium values for conversion of CS_2, said effective amount, expressed by weight of Na_2O, ranging from 1,200 pm to 2,500 ppm.

2. The activated alumina catalyst as defined by Claim 1, said effective amount, expressed by weight of Na_2O, ranging from 1,500 ppm to 2,500 ppm.

3. The activated alumina catalyst as defined by Claim 2, said effective amount, expressed by weight of Na_2O, ranging from 1,700 ppm to 2,200 ppm.

4. The activated alumina catalyst as defined by Claim 1, further comprising silica and/or at least one oxide of titanium, zirconium, cerium, tin, a rare earth, molybdenum, cobalt, nickel or iron.

5. The activated alumina catalyst as defined by Claim 1, further comprising a clay, a silicate, an alkaline earth metal or ammonium sulfate, ceramic fibers, asbestos fibers, or combination thereof.

6. The activated alumina catalyst as defined by Claim 1, further comprising cellulose, carboxymethyl cellulose, carboxyethyl cellulose, tallol, a xanthan gum, a surface-active agent, a flocculating agent, a polyacrylamide, carbon black, a starch, stearic acid,

polyacrylic alcohol, polyvinyl alcohol, a biopolymer, glucose, a polyethylene glycol, or combination thereof.

7. The activated alumina catalyst as defined by Claim 1, comprising extrudates, tablets, or beads thereof.

8. The activated alumina catalyst as defined by Claim 7, comprising a plurality of beads having a diameter size ranging from 1.5 mm to 10 mm.

9. The activated alumina catalyst as defined by Claim 8, said beads having a diameter size ranging from 3 mm to 7 mm.

10. The activated alumina catalyst as defined by Claim 1, deposited onto support substrate therefor.

11. A catalyst comprising at least 0.5% by weight of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm.

12. A catalyst comprising from 60% to 99% by weight of activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm.

13. In a catalyzed Claus reaction for the production of elemental sulfur, the improvement which comprises, as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm.

14. In a process for the catalyzed hydrolysis of an organosulfur compound, the improvement which comprises, as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm.

15. In a process for catalytically removing objectionable sulfur compounds from gaseous effluents comprised thereof, the improvement which comprises, as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na_2O, ranging from 1,200 ppm to 2,700 ppm.

16. The activated alumina catalyst as defined by Claim 1, wherein the catalyst has a specific surface of 350 to 370 m^2/g.

17. The catalyst as defined by Claim 11, wherein the catalyst has a specific surface of 350 to 370 m^2/g.

18. The catalyst as defined by Claim 12, wherein the catalyst has a specific surface of 350 to 370 m^2/g.

19. The reaction as defined by Claim 13, wherein the catalyst has a specific surface of 350 to 370 m^2/g.

20. The process as defined by Claim 14, wherein the catalyst has a specific surface of 350 to 370 m^2/g.

21. The process as defined by Claim 15, wherein the catalyst has a specific surface of 350 to 370 m^2/g.

22. The activated alumina catalyst as defined by Claim 1, comprising beads having a diameter of 3.1 to 6.3 mm and specific surface area of 350 to 370 m^2/g.

23. The activated alumina catalyst as defined by Claim 1, comprising beads having pore volume of alumina of pores of diameter greater than 0.1 μm of 18.5 ml/100g and pore volume of pores of alumina of diameter greater than 1 μm of 15.5 ml/100g.